PUERTO RICO AGRICULTURAL EXPERIMENT STATION
MAYAGUEZ, PUERTO RICO
Under the supervision of the
UNITED STATES DEPARTMENT OF AGRICULTURE

REPORT OF THE PUERTO RICO AGRICULTURAL EXPERIMENT STATION

1933

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PUERTO RICO AGRICULTURAL EXPERIMENT STATION, MAYAGUEZ

[Under the supervision of the Office of Experiment Stations, United States Department of Agriculture]

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PUERTO RICO AGRICULTURAL EXPERIMENT STATION

MAYAGUEZ, P.R.

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INTRODUCTION

Puerto Rico is primarily an agricultural community. When prices for a very limited number of products are above production costs the island is prosperous. When the price of a single commodity—sugar—remains for some time below the cost of production, distress and unemployment follow. In lesser degree, tobacco, coffee, citrus fruits, and pineapples contribute to the island's income.

It has appeared that the most effective contribution of the station to the well-being of the island could be made through work with the major crop, sugar, and one of the principal lines of endeavor has been the production and testing of new seedling sugarcane varieties with which it is hoped to reduce sugar-production costs. The success with which this work is being done is indicated by the already demonstrated value and rapid spread throughout the island of some of the Mayaguez sugarcane seedling varieties.

The sugarcane variety P.O.J. 2878 has given very unequal results when grown on different soils. Its planting in some localities has proved inadvisable, whereas in other localities it has been shown

to be much superior to varieties previously grown there. The station made a survey of the performance of this variety in different localities and the results were prepared for publication. The Bureau of Chemistry and Soils of the United States Department of Agriculture and the Puerto Rico Insular Experiment Station cooperated in respect to soil classifications.

The coffee planter has as yet been unable to recover from the disastrous hurricane of 1928. He is getting along as best he can with small crops and acreages larger than he can properly tend. In the early days of coffee cultivation in Puerto Rico the then more fertile soil justified extensive rather than intensive cultural practices. The loss by washing from the periodically cleaned, steeply inclined slopes, in addition to the fertility lost annually through years of production and removal of the same crop have altered soil conditions more rapidly than the planter's view has changed in respect to cultural practices. Present conditions demand concentration on and more intensive care of the better areas. This involves fertilization which is the most effective means the planter can use to increase production while at the same time reducing acreage. The station is aiding him with experimental work in coffee fertilization and cultural practices and advice based on the same.

Work is also in progress with pineapples, of which a collection of numerous varieties has been assembled, and with root crops which form so important a part of the food supply produced in the island.

In parasitology important studies are in progress on the various parasites affecting livestock and means to combat them. The calls on this department for help are numerous. The recommendations made, if followed, would accomplish much in reducing livestock losses.

The work with sugarcane seedlings, with imported sugarcane varieties, and with corn has been under the direction of R. L. Davis, agronomist; the investigations of cane-sirup manufacture and of the availability of phosphorus to the sugarcane plant, under J. O. Carrero, assistant chemist; the horticultural work under T. B. McClelland, director; and the studies of parasites and diseases of livestock under H. L. Van Volkenberg, parasitologist.

Publications by members of the staff issued during the year were the Report of the Puerto Rico Agricultural Experiment Station for 1932; Agricultural Notes Nos. 60, Absorption and Movement of Plant Nutrients, by C. H. Henricksen; 61, Mayaguez 28, 49, and 63, Three Sugarcane Varieties Commercially Resistant to Mosaic, by R. L. Davis; 62 and 63, Introductory Notes to a Study of Citrus Scab, by H. C. Henricksen; 64, Colics in Horses Caused by Parasites, by H. L. Van Volkenberg; and International Society of Sugar Cane Technologists Proceedings (Fourth Congress) Bulletins Nos. 18, Sugarcane Crosses with Kassoer Selfs, and 19, Sugarcane Seedling Mosaic Elimination, by R. L. Davis.

The station work was adversely affected by two storms within the year. The station lay outside the main path of the September hurricane, and although trees were uprooted and broken and some crops were reduced or destroyed altogether the damages on the whole were comparatively minor.

On March 3, 1933, after 3 months in which the rainfall amounted to less than 3 inches, 17.4 inches of rain fell in a 24-hour period, nearly 15 inches of it falling within approximately 8 hours. As a consequence, the greater part of the arable land of the station was overflowed by the river. Trees, pieces of houses, furniture, clothing, dead fowls, and silt were deposited on the station grounds. Many plants were damaged, killed, or washed out and away. Fences were thrown down or carried away. The station water-supply system was broken by numerous landslides and by the river. Station plantings most severely damaged were the coffee fertilizer experiments, the yam selection work, young sugarcane-hybrid seedlings, and a collection of pineapple varieties. In respect to coffee and yams, the flood damage involved the loss of several years' work.

Upon the retirement from the staff, July 1932, of the station agriculturist, H. C. Henricksen, the fruit growers of Puerto Rico retained Mr. Henricksen's services, and it was arranged that the station was to cooperate as fully as possible in the work projected, a continuation of the work which Mr. Henricksen as a member of the station staff had carried on in behalf of the fruit growers for the past 16 years. The hurricane of September so damaged the citrus plantings of the island that the economic condition of the fruit growers prevented further continuation of the work, to the regret of all concerned.

No other staff changes occurred during the year.

SUGARCANE

DISTRIBUTION OF MAYAGUEZ VARIETIES AND TESTS OF THEIR ADAPTABILITY IN PUERTO RICO

Cane growers and sugar centrals have extended the Mayaguez varieties rapidly during the year, until they now occupy about 2 percent of the area under cane cultivation in Puerto Rico. The

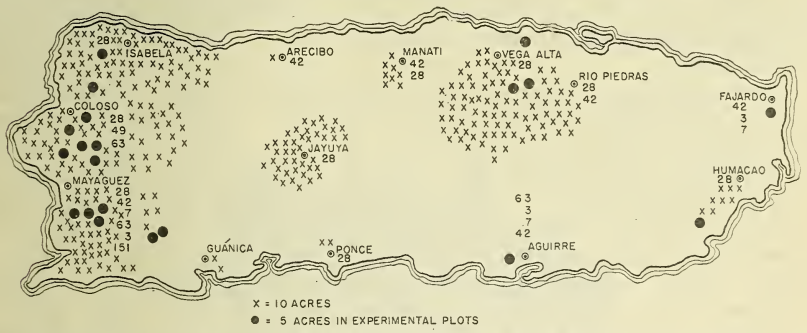


FIGURE 1.—Mayaguez sugarcane seedlings occupy nearly 4,000 acres in Puerto Rico. This is largely a result of rapid extension of culture of Mayaguez 28 which, in May 1933, occupied 2,000 acres on the west coast, 900 acres on the north coast, and 315 acres at Jayuya. The numbers on the map indicate the various Mayaguez seedlings.

approximate area occupied by the varieties in May 1933 is shown in figure 1. Each cross represents 10 acres planted with Mayaguez seedlings. The total area has increased from 1,135 acres in April 1932 to approximately 4,000 acres. Most of this increase is due to the extension of Mayaguez 28.

Cuttings of mosaic-resistant varieties, Mayaguez 28, 49, and 63, were sent out in small lots to 201 farmers. Also approximately 42 tons of cuttings were distributed to the insular experiment station and various centrals for agronomic tests. Favorable results secured with Mayaguez 28 at Coloso, with Mayaguez 63 at Aguirre and San German, and with Mayaguez 7 at San German indicate that they are worthy of still more extensive trials.

Tests of the adaptability of Mayaguez varieties to diverse climatic and soil conditions were continued and extended in various parts of the island. Trials in cooperation with the insular experiment station were made at Centrals Constancia, Carmen, and Eureka, and on the Quinones farm near San German. Twenty trials made in cooperation with sugar centrals are located at Centrals Aguirre, Carmen, Coloso, Fajardo, Pagan, Yabucoa, and in the San German Valley district of Russell & Co.

Special effort was made to locate variety trials on soils typical of large areas of cane lands. Through the cooperation of Ray C. Roberts and James Thorp, of the Bureau of Chemistry and Soils of the United States Department of Agriculture, the soil types of all fields chosen were identified.

Data were collected on stooling habit, which affects the ratooning power and cost of cultivation, and on the growth habit at 8 to 10 months, which has much to do with the proportion of rotten cane and number of water suckers which form. Owing to inclining to recumbent position of canes, Mayaguez 28 and 42 developed considerable amounts of rotten cane in gran cultura plantings.

SUMMARY OF 1933 VARIETY TRIALS

Figures 2 to 9 show graphically the results of the 1933 variety trials. Results were unfavorable to Mayaguez 151 which gave inferior juices, to Mayaguez 49 which ratooned poorly at Coloso, and to Mayaguez 3 and 42 which were inferior to B.H. 10(12) under humid conditions at both Aguirre and Pagan. Mayaguez 3 and 42 as the Margarita trial shows are unsuited to areas where winter drought is common.

The seedlings of promise are Mayaguez 28, which equaled B.H. 10(12) and P.O.J. 2878 in both gran cultura and ratoons at Coloso; Mayaguez 7, which exceeded P.O.J. 2725 by a ton of sugar per acre in irrigated trial in the San German Valley; and Mayaguez 63, which proved superior to P.O.J. 2725 and B.H. 10(12) after a dry ripening period. Mayaguez 28 developed much rotten cane in the Castro San German Valley trial and for this reason was inferior to P.O.J. 2878; caution should be observed in extending it in humid lowland areas where rotten cane may be expected. Mayaguez 63 was superior to Mayaguez 7 in lowland trials at both Aguirre and in the Margarita San German Valley trial. The latter, however, is more drought resistant than P.O.J. 2878 and may prove superior to Mayaguez 63 in upland cultivation. Mayaguez 63 gave very poor juice in the ratoon trial at Aguirre harvested late after a humid ripening period; this result is similar to that of the two 1932 primavera trials in the same area and indicates that Mayaguez 63 should not be cropped on humid lowlands.

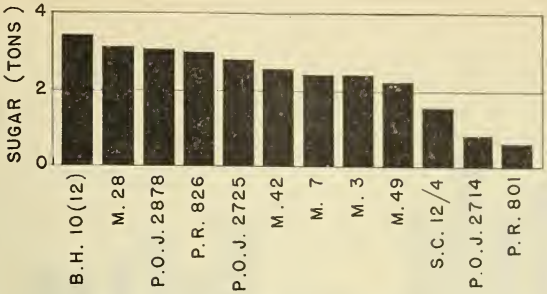
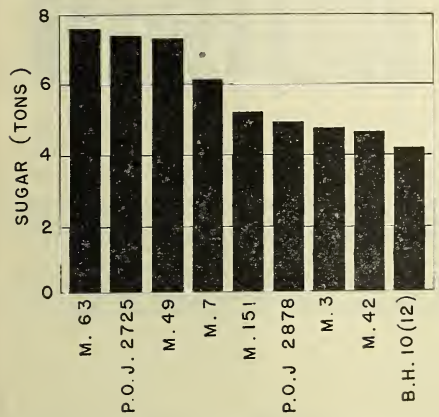


FIGURE 2.—Average yield of sugar from eight 1/20-acre plots of each variety at Coloso. Mayaguez 28 first ratoons compared well with B.H. 10(12) and P.O.J. 2878 at Coloso. Mayaguez 28 was superior to Mayaguez nos. 3, 7, 42, 49, P.O.J. 2725, S.C. 12/4, and P.O.J. 2714. P.R. 826 was inferior to Mayaguez 28 in the gran cultura of the previous year.



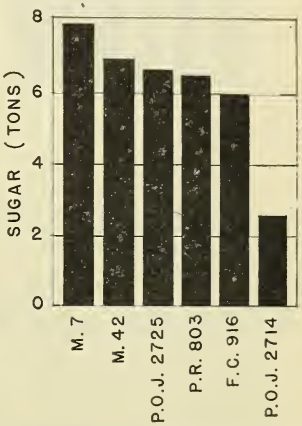


FIGURE 3.—Average yield of sugar from four 1/20-acre plots of each variety in unirrigated gran cultura in the San German Valley. Mayaguez 63 ranked first, and owing largely to its resistance both to drought and to hurricane, outyielded P.O.J. 2725, Mayaguez 7, and P.O.J. 2878 at the Margarita farm. Mayaguez nos. 3, 42, 61, and B.H. 10(12) were eliminated by drought. (At left.)

FIGURE 4.—Average yield of sugar from six 1/20-acre plots of each variety in irrigated gran cultura in the San German Valley. Mayaguez 7 produced a ton more sugar per acre than did P.O.J. 2725 and was superior by a wide margin to Mayaguez 42, F.C. 916, and P.R. 803, on account of a combination of superior cane production and a very high sucrose content. (At right.)

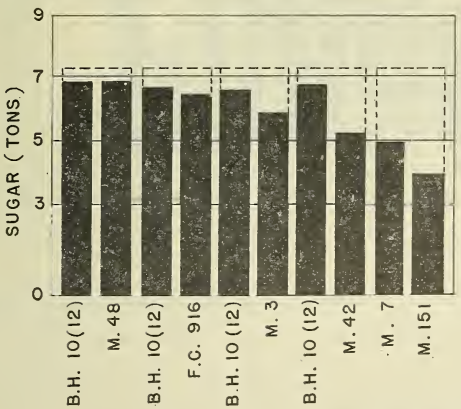
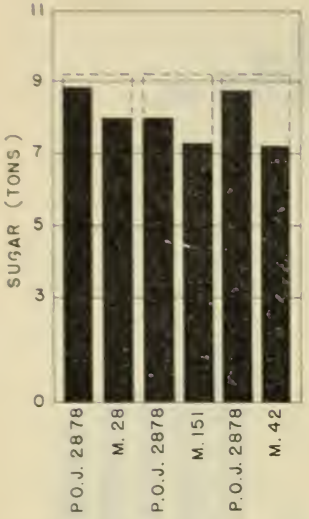


FIGURE 5.—In irrigated gran cultura at Pagan, Mayaguez nos. 3 and 42 were inferior to B.H. 10(12), because of a high proportion of cane that rotted as a result of hurricane. Mayaguez 48 and F.C. 916 developed little rotten cane. Only single plots of F C. 916, Mayaguez 7, and Mayaguez 151 were grown; 2 to 4 plots of one eighth to one fourth acre of the other varieties.



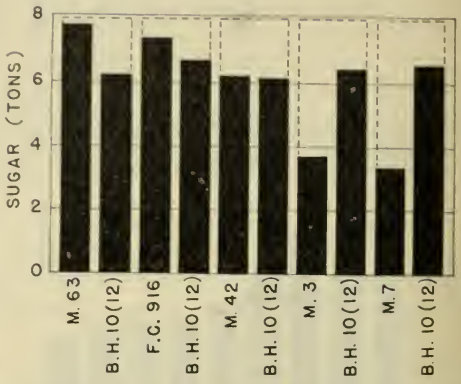
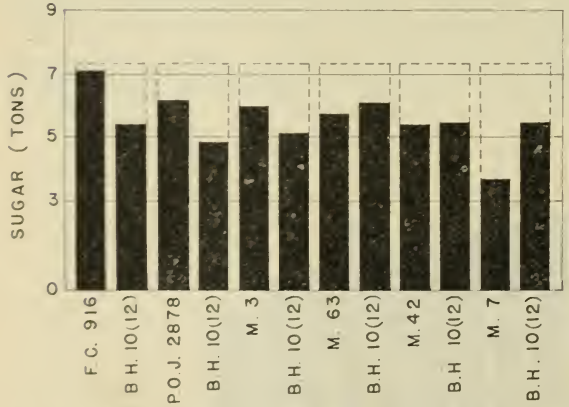


FIGURE 6.—Average yield of sugar from five to ten 1/20-acre plots of each variety in unirrigated gran cultura in the San German Valley. P.O.J. 2878 was superior to Mayaguez nos. 28, 151, and 42. Mayaguez 28 was superior to P.O.J. 2878 in sucrose content but developed much rotten cane as a result of hurricane. (At left.)

FIGURE 7.—Average yield of sugar from two 1/4-acre plots of each variety at Josefa. Mayaguez 63 first ratoons produced nearly 2 tons more sugar per acre than did B. H. 10(12) after a dry ripening period, due to marked superiority in cane production. The sucrose content of these varieties was the same. F.C. 916 was also superior to B.H. 10(12). (At right.)



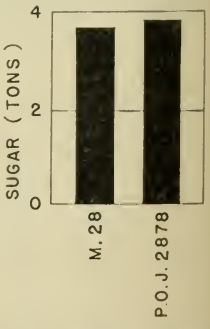


FIGURE 8.—Average yield of sugar from two 1/4-acre plots of each variety, Cortada first ratoons. Mayaguez 63 ratoons were inferior to those of B.H. 10(12) after a humid ripening period. B.H. 10(12) in first ratoons at Central Cortada was superior to Mayaguez nos. 7 and 63. F.C. 916 and Mayaguez 3 were superior to B.H. 10(12). Only single plots of P.O.J. 2878 and Mayaguez 63 were grown. Compare with figure 7. (At left.)

FIGURE 9.—Average yield of sugar from five 1/20-acre plots in unirrigated primavera at Monte Grande in the San German Valley. There was little difference in sugar production between Mayaguez 28 and P.O.J. 2878. The slight lead P.O.J. 2878 had in cane production was largely offset by the superior sucrose content of Mayaguez 28. (At right.)

MAYAGUEZ 28

Of the sugarcane varieties produced by the station, Mayaguez 28 ranks first in importance. Its area under cultivation has more than trebled in 2 years' time and now totals over 3,500 acres. This acreage includes 315 at Jayuya, 600 at Isabela, and 900 at Coloso. Its rapid extension is due to an unusually valuable combination of characters, prolificness, spreading habit, resistance to drought and to mosaic, high purity, and comparative freedom from pithiness and from hollow cane centers. Each of these qualities was investigated during the year.

In gran cultura and first ratoons at Coloso.—In a 2-year trial of gran cultura and first ratoons at Coloso, Mayaguez 28 gave 7.76 and 3.2 tons of sugar per acre, respectively. This production was not exceeded by that of either B.H. 10(12) or P.O.J. 2878. It was superior in each case to that of P.O.J. 2725, S.C. 12/4, and P.O.J. 2714. The cane production of P.O.J. 2725 was about equal to that of Mayaguez 28 both years but the latter was definitely superior in sucrose content. The superiority of Mayaguez 28 to S.C. 12/4 was due largely to its prolific stooling habit, the former producing twice as many canes per stool as the latter. Mayaguez 28's resistance to dry top rot as well as richer juice accounts for its wide margin of superiority over P.O.J. 2714; the latter's stand became depleted by the disease in the first ratoon crop.[1]

Prolificness and spreading stooling habit lower cultivation costs.—Mayaguez 28 is more prolific than any other thick-caned variety now grown in Puerto Rico, including P.O.J. 2725 and P.O.J. 2878. Where open spacing is practiced as many as 20 to 25 canes per stool are not uncommon. This, together with an early growth habit so spreading that the leaves remain almost flat on the ground during the first 3 months, has resulted in low cultivation costs. Mayaguez 28 closes in several weeks earlier and requires one less hand weeding than either P.O.J. 2878 or P.O.J. 2725. The contrast is even more marked with the mosaic-susceptible varieties B.H. 10(12) and S.C. 12/4, which generally require six to eight hand weedings.

Drought resistance.—Mayaguez 28 was previously reported as drought resistant,[2] even more so than S.C. 12/4. This quality has been confirmed on an extensive scale in the Isabela area where Central Coloso grew 50 acres of gran cultura without irrigation; it remained in flourishing condition throughout the dry winter season. The foliage of adjoining fields of P.O.J. 2878 suffered badly from drought and many tops were injured beyond recovery.

The same contrast was noted at Mayaguez in 1932 in gran cultura plantings of both varieties grown in adjacent plots. The leaves of Mayaguez 28 suffered slightly while the tops of P.O.J. 2878 canes became stunted beyond recovery. The dark green fields of Mayaguez 28 show up in sharp relief against surrounding fields of P.O.J. 2878 and B.H. 10(12) which suffer from drought.

Resistance to mosaic.—A special survey was conducted to determine the mosaic resistance of Mayaguez 28 and to what extent rogu-

[1] Additional information on the results of the Coloso gran cultura trial was published for general distribution in Agricultural Notes No. 61, copies of which may be had upon application to the director of the station.

[2] Davis, R. L. JAVA-BARBADOS HYBRIDS IN PORTO RICO. Planter and Sugar Manfr. 83: 83–85, 100, 103–104, 123–125, illus. 1929.

ing might be necessary. Fourteen fields were examined at Centrals Igualdad, Eureka, Coloso, Santa Barbara, Pagan, and at Hormigueros and Mayaguez. In nearly every instance fields were chosen which were near mosaic-infected plantings of P.O.J. 36 or of Co. 281, so that chances favored the spread of mosaic. In spite of efforts to choose the worst fields, mosaic infection rarely affected more than 3 to 4 percent of the shoots. During the time of the survey, from 1931 to 1933, inclusive, mosaic spread very rapidly and increased from little more than zero to 90 or 100 percent in fields of susceptible varieties in the immediate vicinity of the inspected fields of Mayaguez 28. In the latter fields, where infection appeared, completely infected stools predominated, indicating that infected cuttings had been planted and that secondary infection had been very light. In the Anasco and San German Valley districts where an effort was made to plant mosaic-free cuttings of Mayaguez 28 and to keep it rogued, one roguing was sufficient to keep the infection down to 1.5 percent even in fields adjoining a constant source of infection.

The results of the survey indicate that mosaic infection in Mayaguez 28 spreads very slowly and is not apt to become a serious factor. The seed beds of Mayaguez 28 should be kept free from mosaic by digging out infected stools; this is a very inexpensive operation and will keep mosaic infection at a very low level in general field plantings.

Where mosaic is a limiting factor as at Isabela where the cost of replanting stools of S.C. 12/4 destroyed by mosaic is almost prohibitive, expense on that account has been drastically reduced through the introduction by the station of the mosaic-resistant canes, P.O.J. 2878 and Mayaguez 28.

High purity.—For 7 years Mayaguez 28 has proved to be superior to P.O.J. 2725 in juice quality. The data for the gran cultura and first ratoon variety trials at Coloso (fig. 2) are of particular interest as they indicate that in purity percentage Mayaguez 28 outclasses P.O.J. 2725 and is even superior to B.H. 10(12), S.C. 12/4, and P.O.J. 2878. The margin of superiority in purity percentage over the three last-named varieties was from 1½ to 2 percent in the first ratoon crop; considering that the percentage of broken cane tops due to the hurricane of September 1932 was higher for Mayaguez 28 than for any other variety under trial at Coloso, its very high purity is of unusual interest.

Arrowed stalks comparatively free from pithiness or hollow centers.—Mayaguez 28 was reported by cane growers of Isabela and Coloso as practically free from drying out or pithiness in cane tops. Examinations at Coloso, Mayaguez, Cabo Rojo, and at Central Mercedita, Ponce, substantiated this claim. Averages of only 7 to 8 inches of pithy canes were found on arrowed canes of Mayaguez 28 and below this the cane centers were usually entirely solid. No pithiness was found in nonarrowed canes or in canes with tapered tops in which arrows had failed to develop. Under the same conditions both P.O.J. 2725 and P.O.J. 2878 developed from 2 to 3 feet of pithy cane tops on arrowed canes; furthermore pronounced pithiness was observed in canes with tapered tops and even in nonarrowed stalks.

The loss per cane due to drying out of arrowed cane tops is estimated to be approximately four times as great for either of these Javan varieties as for Mayaguez 28 in fields where the latter blossoms. The advantage of Mayaguez 28 over P.O.J. 2725 is often greater than this, however, since arrowing is often practically nil for Mayaguez 28 in localities where P.O.J. 2725 blossoms profusely.

Due to its comparative freedom from pith or hollow centers, Mayaguez 28 canes have a high specific gravity. At Coloso and Mayaguez they proved nearly one tenth heavier than water, whereas those of P.O.J. 2725 barely equaled water in weight. The combination of high sucrose content and high specific gravity results in low transportation costs per ton of sugar for Mayaguez 28. This item of expense is important where canes must be hauled 10 to 15 miles.

Adaptability on Isabela red clay.—Trial plantings made in 1931 demonstrated the adaptability of Mayaguez 28 to the friable red clay soil of Isabela. This soil is so loose that irrigation water soon after application drains away rapidly from below. On such soil a variety having a strong root system, drought-resistant foliage, and ability to cover the ground rapidly is required. Mayaguez 28 met all these requirements. At Isabela its foliage proved to be very drought resistant, its root system developed rapidly and functioned well even when deprived of irrigation water, and many spreading shoots and broad leaves covered the ground even more rapidly than did those of P.O.J. 2878.

As a result of the favorable growth made by the trial plantings and the satisfactory sugar production in the Coloso variety trial the Isabela cane growers rapidly extended the planting of Mayaguez 28. It now occupies 600 acres and is one of the principal varieties in the Isabela district.

Primavera plantings of Mayaguez 28 at Isabela harvested in the spring of 1933 on the holdings of Central Coloso and on the Carlos Cabrera farm gave satisfactory results. The juices were very rich, rarely falling much below 85 percent purity, and were generally superior to those of P.O.J. 2878 ratoons harvested at the same time.

Arrowing of Mayaguez 28 was practically nil in primavera which had been planted at Isabela in March and April. Mayaguez 28 has therefore a big advantage over P.O.J. 2725 in the Isabela area since the latter arrows freely there in April or May plantings.

Valuable for hillside planting.—Mayaguez 28 has been planted on a large scale on steep hillsides near Jayuya at elevations of 1,000 to 1,500 feet. It is rapidly replacing P.O.J. 2725 and now occupies 315 acres. The Jayuya cane lands are for the most part so steep that all land preparation and cultivation are done with hand labor. The heavy rainfall on the steep inclines causes very rapid erosion where land is left uncovered for any length of time. It is therefore very desirable in planting such slopes to have a prolific variety that closes in rapidly. P.O.J. 2878 and P.O.J. 2725 have been used with some success, but both are considered inferior to Mayaguez 28. Mayaguez 28 spreads out and covers the ground more rapidly than either, does not have the uprooting tendency so objectionable in P.O.J. 2878, and gives a higher percentage of sugar in cane than P.O.J. 2725.

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Demonstrated adaptability should precede extension.—The station has never advocated the wide extension of Mayaguez 28, notwithstanding its many excellent characteristics, on areas where its adaptability is unknown. On the contrary, centrals have been urged to include it in variety trials and to keep the commercial plantings down to a minimum until its adaptability has been fully demonstrated.

Mayaguez 28 has a sucrose content superior to that of P.O.J. 2725 and has a twofold advantage over S.C. 12/4 in its superior resistance to drought and to mosaic. Furthermore it was superior in sugar production to both of these canes in the Coloso 2-year variety trial. The station has therefore urged its trial in upland areas along the north coast where S.C. 12/4 and P.O.J. 2725 are the principal varieties.

Mayaguez 28 gran cultura has in several instances developed much rotten cane in the San German Valley. In gran cultura the canes of Mayaguez 28 become reclining to procumbent and are apparently more susceptible to decay than those of P.O.J. 2878. The station cautions planters against the cropping of Mayaguez 28 as gran cultura in humid lowland areas along the north coast until its adaptability to such areas is known.

MAYAGUEZ 63

A promising variety.—Mayaguez 63 is at present second in promise among the Mayaguez hybrids and now occupies over 100 acres. It has very large canes and healthy, dark green, tough leaves free from spots. In addition to being resistant to drought and mosaic it is also resistant to hurricanes. Recent tests indicate that it compares well with P.O.J. 2725 in sucrose content. Some of the desirable qualities of Mayaguez 63 are late or sparse arrowing, free shedding of leaves, freedom of the leaf sheaths from irritating hairs at harvest time, erect growth habit, and large, heavy, solid canes that resist decay. It is not very prolific, but care in selecting planting material will prevent low germination.

In unirrigated gran cultura.—In the unirrigated gran cultura variety trial conducted at Margarita farm near Hormigueros, in cooperation with Russell & Co., Mayaguez 63 ranked first and produced a quarter of a ton more sugar per acre than P.O.J. 2725. The sucrose content was the same for the two varieties, but the cane tonnage of P.O.J. 2725 was inferior. The superiority of Mayaguez 63 was due largely to its hurricane resistance. The proportion of rotten cane resulting from the hurricane of September 1932 was two to three times as great for P.O.J. 2725 and P.O.J. 2878 as for Mayaguez 63.

In primavera and first ratoons.—The results with Mayaguez 63 in Central Aguirre primavera in 1932 indicated its superiority to B.H. 10(12) in cane tonnage, but the latter cane ripened better under the very humid condition that prevailed prior to harvest. In the 1933 first ratoon trial, however, with normal ripening weather, Mayaguez 63 equaled B.H. 10(12) in sucrose content and exceeded B.H. 10(12) by 2 tons of sugar per acre. In a second trial of first ratoons harvested in May 1933 under humid conditions the juice of Mayaguez 63 was quite inferior to that of B.H. 10(12).

Drought resistant and germinates well in ratoon crops.—Although the canes of Mayaguez 63 at Margarita farm developed normally and averaged over 1½ inches in diameter, demonstrating drought resistance, those of B.H. 10(12) became stunted during the dry winter season and never recovered. Whereas Mayaguez 63 averaged over 60 tons of cane per acre, B.H. 10(12) barely exceeded 30 tons. B.H. 10(12) is clearly unsuited to the unirrigated clay and silty clay soils of the San German Valley similar to that on which the trial was conducted.

Mayaguez 63 is not very prolific; as plant cane it produces approximately the same number of canes per stool as B.H. 10(12). As is apt to be true with very large girthed canes, germination is at times somewhat unsatisfactory and the resulting stands irregular. Even under this handicap, however, the first crop of Mayaguez 63 has invariably yielded excellent tonnage. In the first ratoon crop very little replanting is required and many new canes are formed so that the size of the stool approaches that of the female parent, P.O.J. 2725. The mortality in canes is very low in the first crop, and with rare exception the rootstock of each harvested cane produces its full quota of shoots. Furthermore, the drought resistance of Mayaguez 63 favors a good germination under conditions that cause a depleted stand in ratoons of B.H. 10(12).

MAYAGUEZ 3 AND 42 ARE NEITHER DROUGHT NOR HURRICANE RESISTANT

In the Margarita trial in the San German Valley, Mayaguez 3 and 42 were practically eliminated by the winter drought.

In the Pagan variety trial under irrigation, gran cultura of both of these varieties developed much rotten cane as a result of the hurricane. This was particularly pronounced in the case of Mayaguez 42 which subsequently developed many large water suckers. The proportion of rotten B.H. 10(12) canes was much less than that for either Mayaguez seedling, and the former was superior in sugar production. Mayaguez 3 is at present considered more promising than Mayaguez 42 in the Anasco Valley. Mayaguez 3 compared well with P.O.J. 2725 in a preliminary first ratoon trial at Pagan and gave a very good sucrose yield there in a field of primavera; it has been included in a primavera trial near Anasco in comparison with P.O.J. 2878.

SECOND TO FOURTH YEAR SEEDLINGS SHOW PROMISE

In preliminary trial at Central Cortada conducted through the cooperation of Maybin S. Baker, agronomist, crosses between B.H. 10(12) and P.O.J. 2725 were generally superior to B.H. 10(12). These hybrids were from arrows collected from the Fajardo Sugar Co.'s breeding plats.

Analyses of crosses of U.S. 541 and U.S. 785 with S.C. 12/4 and P.O.J. 2725 indicate that such crosses give satisfactory juices in midseason. U.S. 541 and U.S. 785 are seedlings of Kassoer secured from the Canal Point, Fla., field station of the Bureau of Plant Industry of the United States Department of Agriculture.

Crosses produced at Mayaguez between Mayaguez 28 and P.O.J. 2878 are apparently commercially resistant to mosaic. They have compared well with standard varieties at both Coloso and Aguirre.

P.O.J. 2878

Ranks first in San German Valley.—P.O.J. 2878 continues to give very satisfactory results in the San German Valley and in upland plantings along the entire north coast. In many cases P.O.J. 2878 has in those areas exceeded other varieties by a ton of sugar per acre. The acreage on the island, largely derived from cuttings distributed by the station, has increased to approximately 20,000 acres.

Through the cooperation of Ray C. Roberts, of the Bureau of Chemistry and Soils of the United States Department of Agriculture, soil types of practically all fields of P.O.J. 2878 on which yield data are available were identified. In general, the rich friable river-bottom soils were unsuited to P.O.J. 2878. Clay soils on which it is difficult to secure a good tilth were as a rule better suited to this variety than to B.H. 10(12).

Sensitive to flooding.—P.O.J. 2878 seems particularly sensitive to flooding; often new growth is stimulated in gran cultura approaching maturity and low percentages of sugar in cane and low yields of sugar result. In areas where the normal rainfall is adequate for cane growth throughout the year, such as the north coast, lowlands subject to flooding should be avoided when cropping P.O.J. 2878.

SUGARCANE JUICE VARIES IN PHOSPHORIC ACID CONTENT

The introduction from other countries of sugarcane varieties not previously grown here, and the breeding of new varieties have necessitated the examination and comparison not only of their different tonnage yields but also of their juice qualities. Comparison of juice compositions and factory behavior showed noticeable differences in some of the juice constituents, especially phosphoric acid. Whenever the percentages of phosphoric acid dropped below a certain value, phosphoric acid had to be added to obtain good factory performance. Investigations are under way to learn whether or not the addition to the soil of more phosphate in a form readily available to the growing plant will correct the deficiency and perhaps increase tonnage as well.

The different varieties have shown pronounced differences in some of their juice constituents, indicating considerable variation in their needs for or in their ability to absorb the nutrients. Such differences, however, are found not only in respect to variety but also in respect to the soil. The same variety has been observed to vary greatly according to the locality where grown, and juices of different cane varieties grown on the same kind of soil for comparative tonnage yield have shown great differences in their constituents.

NEED OF IMPROVED METHODS FOR CANE-SIRUP MANUFACTURE

The sugar business has been greatly affected by improvements in the methods of breeding new sugarcane varieties and by changes in sugar-factory operations, but these changes have not been accompanied by similar improvements in the manufacture of cane sirup. Some of the older cane varieties which yielded first-class sirups with very little trouble have been supplanted by new varieties, which, although possessing numerous advantages over the old varieties, at the same time make the preparation of a first-class sirup more dif-

ficult than formerly. Lack of interest on the one hand and absence of first-class machinery on the other have brought about an almost complete disappearance of a once common product, good sirup, from the local market. As a result, the market offers maple or corn sirup, or an inferior grade of molasses from a sugar central. For a first-grade product, attractive in appearance and pleasing in taste, a fair market could be had in the island, and possibly also in the States. Investigations and laboratory tests of sirup manufacture by the station have brought out certain findings on which to base recommendations for the manufacture of a better sirup than is now available.

Tests carried out with the different varieties have shown differences in their behavior during manufacture. The untreated juices darkened differently on standing, the color varying from grayish to a very dark green. Differences in color also appeared in the defecated juices, although they were not as pronounced as in the untreated juices. The final product varied in color from a golden yellow to a pronounced brown.

The color of the final product is affected by other factors such as the age of the cane, the quantity of lime added to the juice on defecation, and, as a result, the reaction of the defecated juice. The older the cane used, the greater the tendency to yield a darker final product, and, conversely, younger mature canes yield a lighter-colored product. As the reaction of defecated juice changes from slightly acid to neutral or alkaline, the color usually changes from a pale straw to a slightly brown. Thus, to obtain a good, high-grade color in the product it is necessary to leave the juice slightly acid, or to neutralize and restore to the former acidity, after decantation.

The filter press should be used to obtain a clearer, more brilliant defecated juice. Such filtration can be accomplished easily by adding to the juice a small amount of carbonate of lime in addition to the usual application of milk of lime; and the juice should be filtered a second time when partially concentrated in order to obtain a clearer, brilliant final product with less probability of the formation of caramel with a resultant dark color.

COFFEE

SHADING FAVORS COFFEE DEVELOPMENT

In last year's report of the station the beginning of experiments in shading coffee was described. Pronounced differences between the shaded and the unshaded coffee plants have developed, with less pronounced differences between the heavily shaded and the lightly shaded groups. In spite of a very gradual transition from shade to full sun exposure, the unshaded plants were much yellower and less healthy in appearance than were the shaded plants several months after the differentiation in treatments was begun. Some months later the color of the sun-exposed plants improved.

At the outset the unshaded group had a slight advantage in height and in trunk diameter. At the end of a year the trees in both shaded groups had increased in height twice, or more, as much as those in the group receiving full sun exposure, at which time the average height of the latter was 132 centimeters, whereas that of the lightly

shaded and the heavily shaded trees was 195 and 181 centimeters, respectively. This difference in increase in height was due principally to difference in internodal length. On correspondingly located portions of the main stem a section of five internodal lengths averaged per plant 22 centimeters for plants receiving full sun expo-

FIGURE 10.—Coffee under artificial shade at 1 year from setting. Compare with figure 11.

sure and 42 centimeters for the shaded plants. The internodes on lateral branches showed similar response to the differences in lighting, the average length for correspondingly located internodes being 4.5 and 7.3 centimeters for unshaded and shaded groups, respectively.

Leaf counts at the beginning of the test showed the groups to be quite uniform in respect to amount of foliage, averaging 69, 73, and 67 leaves per tree for the unshaded, lightly shaded, and heavily

shaded groups, respectively. Leaf counts a year later showed averages of 530, 812, and 569 leaves per tree for the same groups. Measurements of leaf length at 1 year showed averages of 12, 15, and 15.4 centimeters for the respective groups, the leaf size being directly correlated with the amount of light received.

In general appearance the shaded trees, much taller and with longer branches and larger leaves (fig. 10), are decidedly superior to the fully sun-exposed trees, which are short and with small leaves closely crowded on short branches (fig. 11). The latter, however, in spite of this apparent inferiority, appear to be vigorous and making good growth.

FIGURE 11.—Coffee grown under full sun exposure at 1 year from setting. Compare with figure 10.

As gaged by trunk diameter, height, and foliation, the lightly shaded trees are superior both to those more heavily shaded and to those receiving full sun exposure. Trees in the three groups have blossomed and their individual production will be recorded.

In all countries producing mild coffees, shading is a matter of prime importance and interest, which, however, has received little experimental attention. The study which is being made by the experiment station should furnish information not only of local interest and value but of widespread importance. Unquestionably, many Puerto Rican coffee plantations are too heavily shaded for best results, yet too light shade has often proved disastrous.

COMPLETE FERTILIZER HIGH IN POTASH INCREASES COFFEE YIELD

In the coffee-fertilizer test at Las Vegas, which has been in progress 16 years, the effect of a change in fertilizer formula from nitrogen alone to complete fertilizer analyzing high in potash, made in 1926 and continued thereafter, has proved very effective in increas-

ing production. A plat fertilized every 6 months at the acre rate of 150 pounds of sodium nitrate, 150 pounds of superphosphate, and 150 pounds of potassium sulphate produced, aggregating the last 5 crops, at the acre rate of 2,151 pounds of coffee in the 5 years, or 430 pounds per year. The average annual production rate of the check for the same period was 200 pounds. The annual production rates for the preceding 7-year period were 179 pounds for the former plat which received nitrogen alone prior to the change in formula, and 385 pounds for the check. Whereas the unfertilized coffee showed a much diminished production, the later crops amounting to only a little more than half as much as the earlier crops, the fertilized plat more than doubled in production.

On the advice of the station the use of mineral fertilizers in Puerto Rican coffee plantations is increasing.

Analysis of the crop at different stages of growth from trees subjected to different fertilizer treatments has been started. Preliminary examination has shown no difference in the percentage of nitrogen and phosphorus in a number of the samples.

ROOT CROPS RESPOND TO FERTILIZERS

In Puerto Rico no market is so small as to be without displays of yautias and taros. Near every small house in the country where any gardening is attempted a patch of one or both may be found. The station has made several important introductions of dasheens and taros and has distributed them broadly. They have met with ready acceptance. At present, investigations are being made of the response of this group to fertilization.

In last season's work with dasheens, taros, and yautias, five fertilizer treatments were given—applications of nitrogen, phosphorus, and potash in combinations of two elements (NK, PK, and NP), the three together (NPK), and manure alone. Increased yields resulted from all except the nitrogen and phosphorus combination.

For the crop dug in the season of 1933 five treatments were given, namely, K, NPK, manure, and K and NPK in combination with manure. The standard application per hole was 2 ounces each of ammonium sulphate, superphosphate, and potassium sulphate, and 10 liters (about 2.6 gallons) of manure. The same planting system was followed as in the preceding year, each treatment being given in quadruplicate, the treated rows distributed through the field, and each treated row with two parallel check rows, one on either side 6 feet distant from the treated row. Between each treated and each check row was a guard row.

As in the preceding crop the response to fertilization, as shown by increased production, was more pronounced in the taros and dasheens than in the yautias, although all three responded to fertilizer applications. All treatments, except the application of potash alone to Penang taros, were followed by increased production.

Dasheens, taros, and yautias each gave the maximum increase following the use of complete mineral fertilizer (NPK) in conjunction with manure. In the dasheens the increase amounted to 84 percent, in the Penang taros to 54 percent, and in the yautias to 25 per-

cent. The increase in dasheens, as determined by weight on digging, was 3½ pounds per plant. Estimating on an acre basis and a complete stand, that increase was at the rate of 8½ tons per acre.

YAM SELECTION PAYS

The Morado yam (*Dioscorea* sp.), in its second season of comparative testing, again demonstrated its superior productivity, outyielding by a considerable margin each of four other varieties grown in adjacent rows. One hundred plants produced 461½ pounds of tubers. Extensive distribution of this and other varieties was made to farmers.

A continuation of the selection work with high- and low-yielding strains of the Potato yam (*D. esculenta*) showed most pronounced differences in production in relation to the strain planted. Prior to planting, the tubers of 6 low-yielding plants of the strain selected for low yield were matched as nearly as possible in respect to individual tuber weight with an equal number of tubers from 5 high-yielding plants of the strain selected for high yield. Planted in adjacent rows the crop produced by the group selected for high yield was more than twice that of the group selected for low yield.

Very evidently bud variation in yams may account for wide differences in production. To avoid the chance of crop reduction through planting tubers of low-yielding strains, continuous selection and use of high-yielding plants for seed purposes should be practiced by the planter.

CORN

FRESH FIELD-CORN SEED ESSENTIAL TO YIELD

Tests conducted at Mayaguez and at the Isabela substation in cooperation with the insular experiment station demonstrated that corn grown from seed freshly harvested is the best. Old corn seed which had not been protected from the moist air germinated poorly and made a slow, weak growth which inevitably results in crop failure. If seed from a recently harvested crop is not available, resort should be had to seed which has been carefully selected from the previous crop, fumigated, and stored in airtight containers.[3]

CROSSING SWEET CORN AND FIELD CORN INCREASES HEIGHT AND EAR LENGTH OF NATIVE SWEET CORN

To develop a native sweet corn with ears and plants approaching those of field corn in size, crosses were made between Mayaguez 1 and Mayaguez 3 sweet corn and native field corn. The average height for several ear-to-row selections of pure sweet corn grown during the year after three generations of selection exceeded that of Mayaguez 3 sweet corn by over 1 foot. Figure 12 shows a quarter-acre field of sweet corn at Mayaguez which compared well with field corn in height. As shown in figure 13, thicker, longer ears have resulted from crossing sweet corn and field corn. Seed of these new hybrids is not yet available for general distribution, as selection must be made for a uniform type of ear.

[3] Advice on methods of fumigation and storing was published in Agricultural Notes No. 59, a copy of which may be had upon request to the director of the station.

FIGURE 12.—View of sweet-corn breeding plat at Mayaguez. Many of the plants were over 7 feet to tassel base and compared well with native field corn in height. White bags were used in the hand-pollination of more than 1,000 of the plants.

FIGURE 13.—*A*, Ears of Mayaguez 3 sweet corn; *B*, ears of Mayapuerto 1 sweet corn of the fourth-hybrid generation, which are longer and thicker than those of the former and approach in size the field-corn ear (*a*). These ears were produced at Mayaguez under adverse conditions of very heavy rainfall and consequently poorly prepared land.

NEW HIBISCUS VARIETIES ORIGINATED BY THE STATION

For some years the station has bred and distributed ornamental hibiscus. Among varieties originated at the station the following not previously described are of outstanding beauty: Dr. N. L. Britton, 6 inches or more in diameter, long, slightly narrow petals, in form somewhat suggestive of a lily, silky in texture, pale yellow, flushed with red in the center and a lighter reddish flush extending along the veins; Frances Horne, white with orchid veins; Jean Whittemore, 6 inches across, full crinkly petals, carrot red in color; Mary McClelland, 5 inches across, rounded petals, of crepelike texture, snow white in effect but with a cream flush very faintly discernible on the inner or upper surface of a portion of the petal and a little more pronounced on the lower or outer surface, column creamy white, foliage very decorative, the leaves dark, glossy green with the network of veins standing in relief above the upper surface

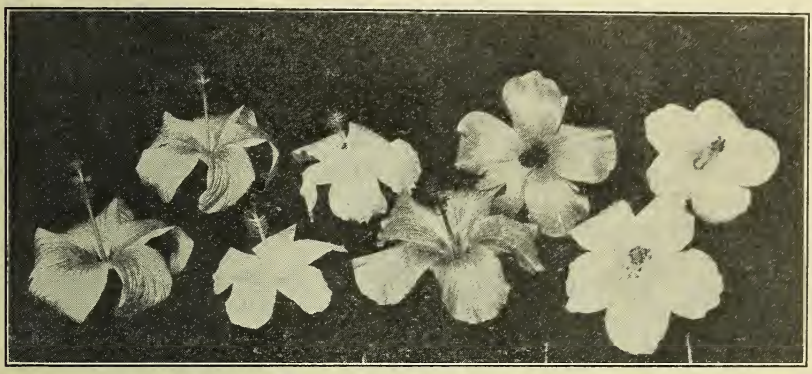

FIGURE 14.—Hibiscus varieties originated at the station. Pairs from left to right, Dr. N. L. Britton, Frances Horne, Jean Whittemore, and Mary McClelland.

of the leaf. These four varieties are shown in the order named, from left to right, in figure 14. Thousands of cuttings and numerous rooted or grafted plants of varieties which have originated at the station have been distributed. The demand for these new hibiscus varieties has been constant, and they are adding to the variety and beauty of the island ornamentals.

ANIMAL PARASITES AND PARASITIC DISEASES

REDUCING PARASITIC INFECTION

Experiments were continued in regard to improving the preventive methods that may be used for controlling parasites. Livestock in the lowlands continue to become heavily infested with internal parasites. In areas most favorable for growing malojillo grass, infestations of stomach worms, nodular worms, hookworms, and liver flukes of calves are prevalent. At the station under similar conditions, where no special preventive measures were taken other than to maintain sanitary pens, calves when fed Guatemala grass grown on hillsides made larger gains in growth and picked up fewer parasites than when fed malojillo grass. This comparison was continued over a long period under various weather conditions. The malojillo

fields at the station, similar to many elsewhere, become contaminated not only by the spreading of fresh manure but also by drainage from adjacent land on which infected animals are maintained. The feeding of malojillo grass to calves 1 year of age or less in the station herd has been discontinued.

The wet lands on which malojillo grass is grown are favorable for the development of parasites. There is danger of infection from any grass grown on such soil. Apparently guinea grass is another medium especially favorable for transmitting the larvae of parasitic worms. Since Guatemala grass must be grown on well-drained soil it is less favorable for the development of parasites. Also, as this grass grows upright and the stalks are comparatively few, the larvae are less able to infest it. These experiments indicate that Guatemala grass may be safely fed at any time during the year provided it does not lie on the ground or is not contaminated with fecal material in the pen. From the viewpoint of parasite control, sugarcane and elephant grass are probably as clean and as safe to feed as Guatemala.

Stockmen should grow at least sufficient Guatemala grass for their calves, leaving the malojillo for the older cattle. Adult cattle usually do not suffer from infestations of worms, except the liver fluke, and this parasite can be controlled by snail eradication. Even in the lowlands there are slopes and hillsides on which Guatemala grass can be grown. It would be profitable to drain many fields and grow Guatemala in preference to malojillo because of the greater acre yield of the former. Dairymen have found that Guatemala and elephant grasses are superior to others for milk production. Guatemala grass grows well on heavy soils, whereas elephant grass gives a higher yield on the light sandy soils.

SIMILARITY OF PARASITES IN PUERTO RICO AND ST. CROIX

The parasitologist made a short visit to the Virgin Islands to examine the animals of St. Croix for parasites. Although the latter island has a relatively dry climate, the rainfall averaging about 45 inches per year, the animals harbor practically the same common and serious types of parasites found in Puerto Rico. The liver fluke is present in St. Croix, but, owing to the small areas of swampy land, it is less common and less serious than in Puerto Rico.

The prevalence of parasites in St. Croix seems to be explained by the comparatively light rains of the rainy season, which must be very favorable for the development of the larvae of parasites. In Puerto Rico the continual heavy rains apparently wash down and carry off a large proportion of the infective material, and the period of heaviest infection occurs during the wet season after the period of daily heavy rains has passed and prior to the dry weather that follows. Climatic conditions in the dry southern coastal region of Puerto Rico are similar to those of St. Croix.

INTERNAL PARASITES OF HORSES

The most injurious parasites of equines in Puerto Rico known at present are the large and small strongyles which are located in the large intestine. The strongyles include all the roundworms, except

the pinworms whose natural habitat is in the caecum and colon. Three species of the large and thirty species of the small strongyles have been collected and specifically identified by the Zoological Division of the Bureau of Animal Industry, United States Department of Agriculture. The large strongyles cause injury by sucking blood and by attacking the walls of the intestine. The small strongyles injure the intestines by feeding on the mucosa. Some species produce ulcers and others nodules. Probably all of the large strongyles in their immature stages wander through the intestines into the liver, pancreas, and other organs. These worms are responsible for digestive disturbances, weakness, emaciation, and anemia.

The three species of large stomach worms (*Habronema*) have been found in Puerto Rican horses. The stable fly and house fly which transmit these worms to horses are very common about the stables. The skin disease of horses known as "summer sores" which is associated with the larvae of the stomach worms is often seen. These sores seem to be more common among the improved breeds of horses of the southern coastal region.

A species of bots is usually found in the stomach and duodenum, but so far always in very light infestations. These bots are the larvae of a fly.

The large ascarid or roundworm of the small intestine has been found. A few specimens have been collected from adult horses, but its incidence among young animals is not known.

The tapeworm (*A. perfoliata*) has been found in Puerto Rican horses. This species is considered the most injurious of the three tapeworms that occur in the horse. It has been found occasionally in horses of the lowland areas. However, heavy infestations have been found in horses and mules from San Sebastian and vicinity.

Lungworms have been found only in light infestations.

The small stomach worm (*Trichostrongylus axei*) has been collected from both cattle and horses.

Pinworms (*Oxyuris equi*) are often found in light infestations.

The threadworm (*Setaria equina*) of the abdominal cavity is usually found on autopsy.

The threadworm (*Onchocerca cervicalis*) of the neck ligament has been found.

COLICS IN HORSES CAUSED BY WORMS

During November, December, and January 1932–33 outbreaks of colic occurred among horses and mules. The disease had appeared in previous years, but until this year the outbreaks on the western side of the island have been less extensive than elsewhere. In the southern coastal region the trouble has occurred during the summer or rainy season. These colics are more noticeable among herds of equines, where the disease may occur as an enzootic. The mortality varies, but in outbreaks investigated it was about 20 percent of the affected animals.

The disease is caused by massive invasions of the larvae of the strongyles. These larvae penetrate the intestinal walls and invade the peritoneal cavity, liver, and other organs of digestion. The larvae of one species enter the large blood vessels which supply the intestine with blood and produce aneurisms. Apparently these larvae,

entering in numbers, dislodge particles of fibrin and debris from the old aneurisms remaining from previous infestations. These particles may become lodged in a smaller blood vessel (embolism), stopping the flow of blood and causing a paralysis of the portion of the intestine supplied by this blood vessel. Some of the animals suffer more than one attack of colic. Sporadic cases also occur. These secondary and separate attacks are more characteristic of the typical cases of embolic colic.

ANAPLASMOSIS AND PIROPLASMOSIS IN CATTLE

Anaplasmosis is a disease of cattle which is similar to piroplasmosis (tick fever). The protozoan organism causing the disease is carried by the cattle tick and other ticks. It may also be transmitted mechanically by veterinary instruments. Apparently this disease is more common than piroplasmosis.

The higher producing cows, especially those of the improved breeds, seem to be more predisposed to the disease and are more liable to be attacked at the time of parturition. Among native or acclimated cattle the mortality is not high, but the greatest loss results from lowered milk production.

In the treatment of the disease considerable dependence must be placed on careful handling and nursing treatment. A veterinarian should be called at once. Medicinal treatment if successful must be administered early in the disease.

Piroplasmosis has apparently become an uncommon disease in Puerto Rico, probably because very few dairy cattle are being imported. When nonimmune or susceptible cattle are introduced in numbers this disease as well as anaplasmosis appear in their more acute and typical forms. Experience has shown that when piroplasmosis occurs in recently introduced cattle, the higher-bred native and acclimated cattle are more apt to be attacked than at other times. Apparently the virulence of the organism is increased by passing through highly susceptible animals.

CYSTICERCOSIS OR "PEPITA" OF SWINE

The parasite *Cysticercus cellulosae* found in the pig is the intermediate state of *Taenia solium*, a tapeworm of man. Investigation of the prevalence of the parasite showed that it is much more common than is indicated by inspection of meat carcasses at the abattoirs. The incidence of infestation among swine is high in some localities, and the tongues of the pigs are inspected for the cysts or bladder worms before purchase. Maurice C. Hall, of the Bureau of Animal Industry, United States Department of Agriculture, brought to the station's attention an anomaly in connection with this parasite. According to parasitologists who are familiar with the parasites of man, the beef tapeworm (*T. saginata*) is in man the common tapeworm in Puerto Rico, while *T. solium* is infrequent. The cysts of the beef tapeworm are seldom found in Puerto Rican cattle. The unusual factor is not that the intermediate stage in cattle is not found, as it can be easily overlooked, but that although the intermediate stage in pigs is not uncommon the adult tapeworm is rarely found in man.

NOTES ON THE STATION DAIRY HERD

Table 1 records the milk and butterfat production of the station herd of purebred Guernseys. These records are of complete lactation periods terminated during the fiscal year 1933.

TABLE 1.—*Milk and butterfat production of 6 Guernseys at the Puerto Rico station for the year ended June 30, 1933*

Name of cow	Rest period	Length of time in milk	Total yield of milk	Total yield of butterfat	Proportion of butterfat
	Days	*Days*	*Pounds*	*Pounds*	*Percent*
Lorna	55	402	9,889	341	3.4
Mayaguezana	64	556	9,726	402	4.2
Gerar Tsoie	75	415	6,952	294	4.2
Rose Tsoie	74	302	5,586	252	4.5
Estella (heifer)	----------	420	5,899	243	4.1
Marina (heifer)	----------	366	4,041	200	4.9

EROSION AND TERRACING

The greater part of Puerto Rico is hilly or mountainous and subject to torrential rainfall. The muddy streams indicate a part of the erosion which is going on and which years of hillside cultivation have accentuated. The loss of so much irreplaceable soil continues at an appalling rate. This is a major problem to which experimental attention should be directed. The terracing of station land begun last year has been continued, making on steep inclines flat terraces with drops of 3 to 6 feet between terrace levels. Banks set with *Cordyline guineensis* at the end of a year were as yet insufficiently protected against washing. Under the conditions of the experiment a longer period is evidently required for the development of an efficiently protective covering. On the slopes of the terraces made within the year, Guatemala grass has been planted to test its effectiveness in preventing erosion.

MISCELLANEOUS ANALYTICAL WORK

In addition to the principal analytical work of the station, analyses of the juices of different sugarcane varieties under trial, including new seedlings developed by the station, the station has responded to requests from farmers for analyses of samples of canes, limestones, soils, bat guanos, and irrigation and well waters. The demands for help are greater than the station is able to supply with its reduced staff.

COOPERATION WITH AGENCIES OUTSIDE THE ISLAND

The New York Homeopathic Medical College has been investigating the clinical value of the fruit of *Solanum indicum*. This plant grows wild in Siam, where curative properties in the treatment of diabetes have been ascribed to its fruit. Fruits were grown and cured by the station and shipped weekly to the college. The tests were reported to have shown insufficient clinical value to warrant continuation.

The station is also cooperating with the College of Agriculture of the University of California in lima-bean investigations, growing a number of California varieties in comparison with one another and with Puerto Rican varieties. The variety King of the Garden at 4 months after planting had proved the most prolific of 7 California varieties included in the test, producing first mature seed at 3 months, whereas the Puerto Rican sorts at 4 months had matured practically no seed. The former variety is recommended for home gardens on account of vigor, earliness, prolific production, and high quality.

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